

**COMPOSITE ENVISIONS KNOWLEDGE HUB  
PRACTICAL AND INSIGHTFUL COMPOSITES INFORMATION**



# **SIZINGS - WHY DO THEY MATTER**



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## INTRODUCTION

Sizings are surface coatings on fibers that hold two major roles in making fibers effective today throughout the composite industry. Sizings are applied to various fibers to protect them from breaking during the manufacturing process of winding or fabric weaving and to enable them to be more compatible with given resin matrix systems. Sizings / Binders can be viewed as an effective primer of sorts, simply promoting adhesion between fibers and resin.

Without sizing, the fibers and resin matrix may not adhere as effectively, thus when loading, the designed transfer of energy from the resin to the fabric may be broken, yielding a weaker composite structure. Sizings are also important for chemical resistance and thermal stability in various fibers.

Sizings types determine where a fabric is best used, whether it be prepreg tapes, woven fabrics, filament winding, or even a chopped strand mat, depending on the fiber type. The good news is that effective pairing of a specific fiber product to a resin is generally only requires a little research before selecting the perfect fabric and resin combination.

## CARBON FIBERS

Large fabric manufacturers treat fibers with various sizing agents to achieve a desired surface enhancement of a fiber. These sizing types will determine the fiber's capability with a given resin and the processes it will be most effective with. Most manufacturers may not share what exactly their proprietary formula is, but they do share how it can be used most effectively. With carbon fibers, epoxy is generally going to be compatible with all sizing applications.

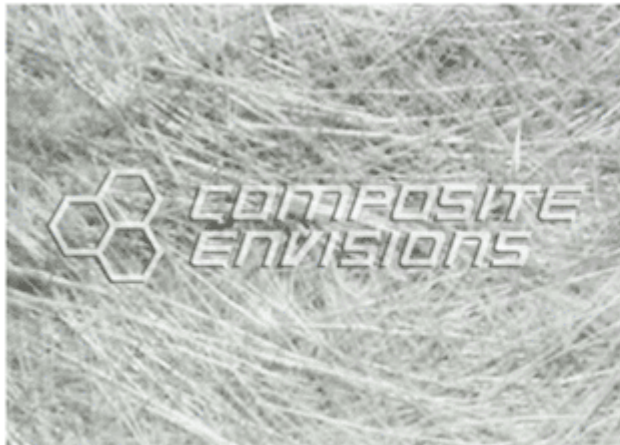
It is important for the end user to take caution when selecting and a carbon fiber fabric type when using Phenolic, BMI, Vinyl Ester or Polyester resins as sizing compatibility may be critical when achieving resin adherence to the fibers and a part performing as designed. Researching this may involve more than reading through a product specific technical data sheet, however, technical manuals of manufacturers will state the sizing types placed on an array or product lines within the fabric thus giving the resin compatibility within. Many of the sizings made for carbon fiber are already designed for a specific application such as going into a prepreg or when using them in filament winding.

## FIBERGLASS

Sizings have an even higher implication on fiberglass fibers and fabrics than carbon fibers. Fiberglass without sizing is abrasive but does not have good abrasion resistance. (Try not to think about how badly fiberglass in the skin feels inside pores...ITCHY!!) If it were not for sizing in fiberglass, a fabric product may resemble a hair ball after attempting to be worked



into a weave or mat material. There would be no workability without aid of a sizing. However, unless someone is designing the newest form of fiberglass, anyone laying it up shouldn't have much to worry about the molecular makeup of a sizing. Instead, simply researching a fiberglass product for a sizing or binding agent is important for which type of resin to use effectively.



CSM Fiberglass carries a Styrene Sizing Agent to hold it together for processing. Effectively dissolved by Poly / Vinylester Resins



Many "stitched" fiberglass products do not have this sizing and are compatible with all resin types.

## CHOPPED STRAND MAT

Fiberglass products such as CSM have been used effectively with Poly / Vinylester resins for a long time. There are many questions involving if epoxy resins work with CSM. Many Chopped Strand Mats carry a styrene sizing that holds the randomly oriented fibers in place. The design behind this sizing feature enables poly or vinylester resins to easily soak into CSM, dissolve the styrene sizing layer, and effectively bond the CSM layers. Epoxy on the other hand does not dissolve the styrene sizing layer but instead only encases the CSM fibers. Epoxy resins do not work as effectively in CSM due its inability to dissolve this styrene sizing. Consequently, producing a heavier and less effective laminate. In the end, CSM can be made with Epoxy resin when it is the only resource available. Epoxy will perform in a pinch with styrene sized CSM but not nearly as well as Poly or Vinylester resins.

There are however types of CSM that do not have a styrene sizing placed into them. This is often a fiberglass product that is stitched together instead of having a styrene coating. Epoxy or Poly / Vinylester resins would work just as well in this case.

## KEVLAR

Although sizing is important to Kevlar fabrics in making them more acceptable to a given resin, as with Carbon Fiber and Fiberglass. There is not much to add for sizing in an



application scale. Various sizings on Kevlar will help promote thermal stability, chemical resistance and bonding based on the end users need.

It is also important to note that sizings degrade over time, sizings are one of the determining factors in a fabric's or prepreg's shelf life. As a sizing degrades, the chemical bonds between the sizing "primer" and the fibers degrade. Consequently, the bond between the fibers and the resin being introduced may not be as strong. Leading to possible mechanical failures within the composite laminate.

Composite Envisions LLC  
8450 Development Court  
Wausau, WI 54401 USA  
+1 715-842-0101  
info@compositeenvisions.com  
<https://compositeenvisions.com/>



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